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(71) Applicant
Soil Instruments Limited (United Kingdom),
Bell Lane, Uckfield, Sussex TN22 1QL

(72) Inventors
M. A. G. Parsons,
Gary Cooper

(74) Agent and/or Address for Service
J. B. King, Kings Patent Agency Limited, 146a Queen Victoria Street, London EC4V 5AT

(54) Indicating soil moisture content

(57) A tensiometer comprises a tube 4 which is filled with deaired water, the filling continuing until a mensiscus upstands from the top of transparent reservoir 2. The reservoir is closed by means of a cap 1 of which the inner facing surface 1a is of conical shape with the apex extending into the reservoir. Thus any entrained air and surplus water is expelled through overflow port 1d as the cap is tightened, ensuring that no air is trapped within the reservoir. The lower end of tube 4 carries a water permeable ceramic tip 5 and prior to filling, the assembly is inserted vertically into the ground with the tip 5 positioned at the depth to be tested.

FIG. 1.

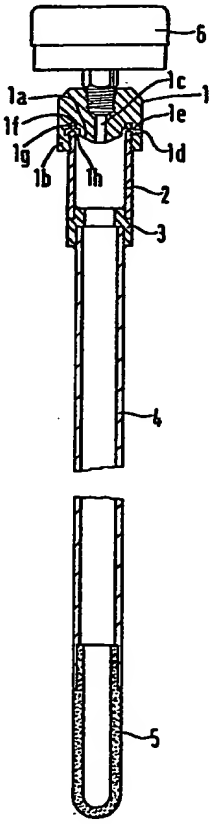

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FIG. 1.

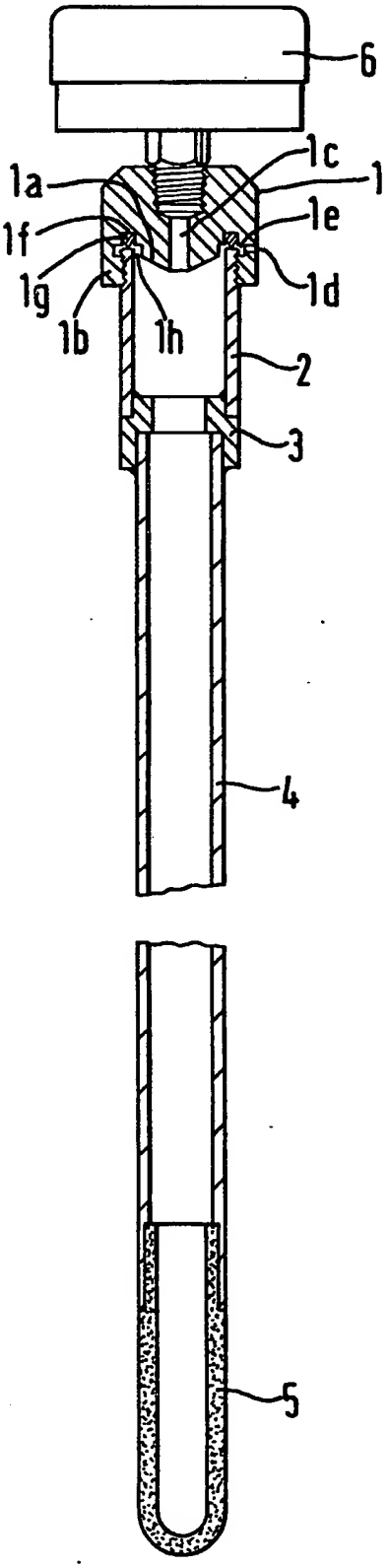


FIG. 2.

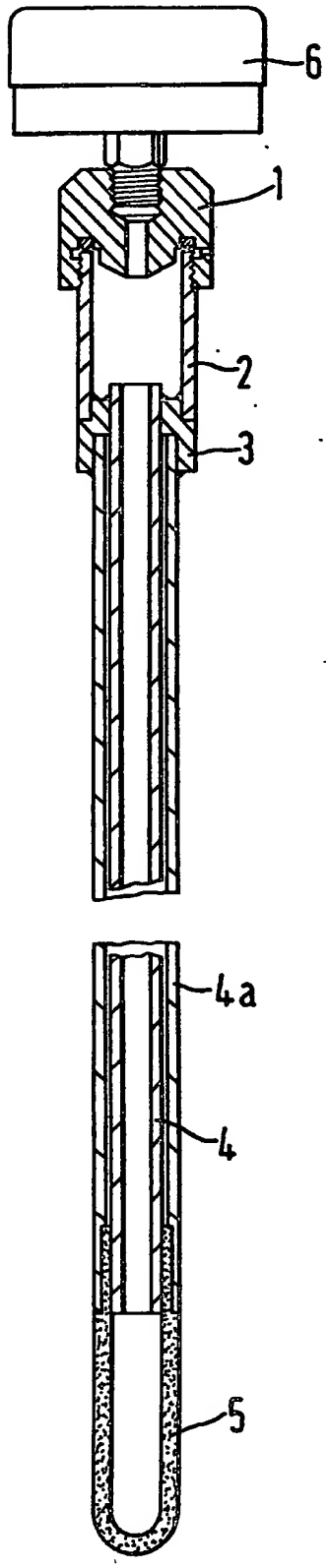
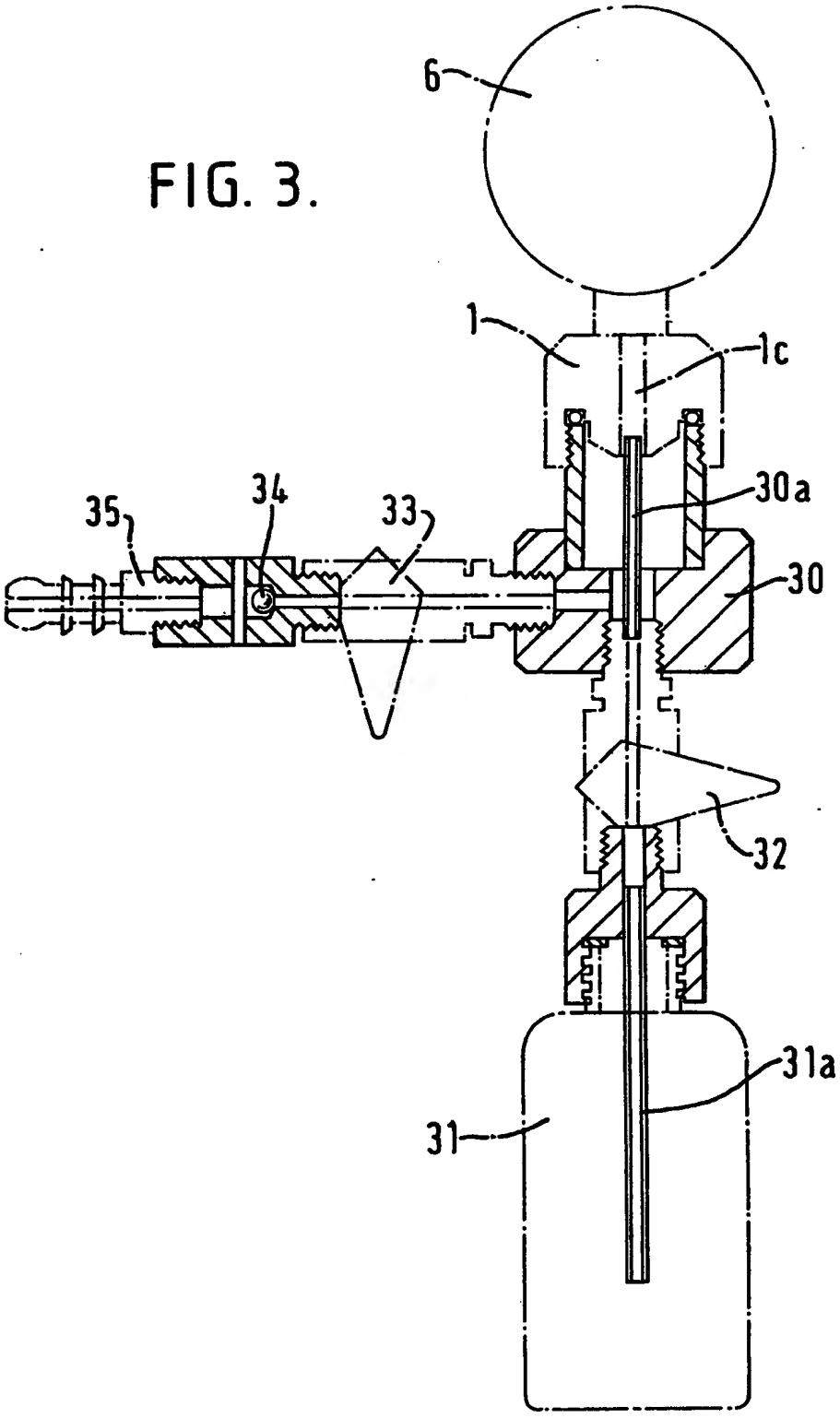


FIG. 3.



SPECIFICATON

Instrum nts for indicating soil moisture cont nt

This inv ntion relates to instruments for indicating th moisture cont nt of soils, such instruments being known as "tensiometers". Such term will be used hereinafter.

Tensiometers are used to indicate whether or not a section of cultivated ground requires irrigation and are normally inserted into the soil at appropriately spaced locations. Such instruments should ideally be of low cost, and have good accuracy and should require as little as possible skill in setting up.

Tensiometer instruments to which the invention relates have a body containing water with a porous ceramic membrane which is inserted to the appropriate depth in the soil. The ceramic membrane forms a tip to the instrument and a suction effect is created according to moisture content of the soil with the suction being indicated on an appropriate instrument. Such instruments can suffer from loss of water through the permeable tip and this is greatly affected by the gaseous content of the water, in particular entrained air within the instrument body.

It is an object of this invention to provide a tensiometer instrument which is of simple construction and which can be filled with water in a simple manner which avoids significant quantities of air being entrained.

According to this invention a tensiometer comprises an elongate tube having a porous ceramic tip at one end and a fluid reservoir at the other end, the open upper end of the reservoir being closable by a cap carrying a pressure gauge with the inner facing fluid contacting surface of the cap projecting, a fluid overflow port being provided in a side portion of the cap and arranged so that as the cap is fitted to the reservoir any air and fluid are displaced through said port.

Preferably the fluid reservoir is of a transparent material or has a transparent portion. The surface of the cap will preferably project conically as such a surface may be formed readily.

In use the body of the tensiometer is inserted into the ground with the porous tip at the required depth and the reservoir filled to form a meniscus of fluid upstanding from the top of the reservoir. Preferably the cap and reservoir are interconnected by screw threading with a sealing member provided within the cap. As the cap is screwed down air is initially displaced through a port in the side wall of the cap followed by displacement of the fluid which forms the meniscus. The internal surface of the cap contains a conical projection which further serves to displace fluid. This ensures that the reservoir is substantially free from air. With tensiom ters it is important to ensure xclusion of air which will otherwise caus unacceptabl quantities of water to be drawn out through the tip and also cause a serious lag in response time.

Th cap preferably includes a pr ssur gauge conn ct d directly therewith and op rativ ly coupl d via a passag way op ning at the apex of th con forming the inner cap surface. Th fluid overflow port in the cap may be positioned clos ly adjac nt the periphery of th conical inn r surface and the threaded side wall serving for connection with the reservoir. The overflow port will preferably communicate with a groove located around the inner periphery of the cap.

Further details apertaining to the invention are described by way of example shown in the accompanying drawings, wherein:

Figure 1 shows a longitudinal section through one embodiment of tensiometer according to the invention,

Figure 2 shows a similar view of the second embodiment, and

Figure 3 shows an apparatus for filling the pressure gauge with water.

Referring firstly to Figure 1, a tensiometer comprises an elongate cylindrical body 4 to one end of which is secured a water permeable ceramic tip 5. The other end of tube 4 carries a connector 3 which supports a transparent reservoir 2. The assembly is inserted into the ground to an appropriate depth with the tip 5 being at a level at which it is desired to monitor the water content. The tube will be positioned vertically.

After installation the tube 4 is filled with deaired water and the filling continues into reservoir 2 until a meniscus upstands from the top of the reservoir. The reservoir is closed by means of a cap 1 of which the inner facing surface 1a is of conical shape with the apex extending into the reservoir. The conical surface 1a is connected to the body of the cap 1 by an extension shoulder 1h which is parallel with and spaced slightly from the inner wall of reservoir 2. This brings the surface 1a more into the reservoir 2 when screwed home.

The cap includes a skirt 1b with screw threading engaging complementary threading at the top of the reservoir 2. The cap 1 carries a pressure indicating gauge 6 which communicates via passageway 1c with the apex of the conical surface 1a. After filling the reservoir and the tube, cap 1 is screwed on to the reservoir 2 and partly due to the meniscus which upstands from the reservoir caused by surface tension and partly due to the conical surface 1a, water is displaced through a port 1d which communicates with an internal circumferential groove 1e. Thus, as the cap 1 is screwed home any entrained air and surplus water is expelled through port 1d, the conical surface 1a in conjunction with shoulder 1h thus ensuring that little or no air is trapped within the reservoir. The cap 1 also includes a groove 1f housing a sealing ring 1g which forms a watertight seal with the top of the reservoir 2 wh n the cap is fully home.

By providing the reservoir 2 of transparent material, visual obs rvation of the ingr ss of any air can b made during normal use.

Prior to fitting the cap 1 tog th r with gauge 6,

this assembly is filled with de-aired water and a convenient means for achieving this is illustrated in Figure 3. In this arrangement the cap 1 with gauge 6 is fitted to one limb of a T-fitting 30, the lower limb of which is coupled to container 31 for de-aired water and coupled via a valve 32. A tube 31a extends into container 31 to below the water level and connects via valve 32 with an injection tube 30a extending into the bore 1c in cap 1 and communicating with gauge 6. The remaining limb of the T is connected via further valve 33 and non-return valve 34 with a vacuum pump fitted to connector 35. To ensure complete filling of the gauge 6 air is first of all exhausted via the vacuum pump connector 35 whilst valve 33 is open and valve 32 closed. When all air has been exhausted the valve 33 is closed and water may then be introduced into gauge 6 through connector 1 by opening valve 32, and thus allowing water from container 31 to flow into the valve unit. The valve and cap will retain the water sufficiently to enable the cap to be fitted to the reservoir 2. The apparatus will conveniently be constructed of plastics material and with the various parts 4, 3 and 2, may be joined by cementing with an appropriate tip 5 being cemented to the bottom of the tube.

A modified arrangement is shown in Figure 2 wherein the tube 4 is sheathed in a further protective tube 4a which is connected to the tip 5. The tube 4 passes through the centre of the connector 3 and is cemented to same.

The arrangement described provides a particularly simple and low cost construction which can be assembled in a simple manner whereby air is automatically displaced during the attachment of the cap. The device can also be readily topped up with de-aired water whilst installed.

CLAIMS

1. A tensiometer comprising an elongate tube having a porous ceramic tip at one end and a fluid reservoir at the other end, the open upper end of the reservoir being closable by a cap carrying a pressure gauge with the inner facing fluid contacting surface of the cap projecting, a fluid overflow port being provided in a side portion of the cap and arranged so that as the cap is fitted to the reservoir any air and fluid are displaced through said port.

2. A tensiometer in accordance with Claim 1, wherein the fluid reservoir is of a transparent material or has a transparent portion therein.

3. A tensiometer in accordance with Claim 1 or 2, wherein the surface of the cap projects conically.

4. A tensiometer in accordance with any preceding Claim, wherein the cap and reservoir are interconnected by screw threading with a sealing member provided within the cap.

5. A tensiometer in accordance with any preceding Claim wherein the cap includes a pressure gauge connected directly therewith and operatively coupled via a passageway opening at the apex of the cone forming the inner cap surface.

6. A tensiometer in accordance with any preceding Claim, wherein the port in the cap is located closely adjacent the periphery of the projecting surface of the cap and the side wall of the cap.

7. A tensiometer in accordance with Claim 6, wherein the port in the side wall of the cap communicates with a groove provided around the inner periphery of the cap adjacent the base of the projecting surface.

8. A tensiometer constructed as herein described and as shown in Figures 1 or 2 or 3 of the accompanying drawings.

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